A SUMMARY REPORT

of

THE IMPLEMENTATION AND SUSTAINABILITY OF INSECTICIDE-TREATED MOSQUITO NET (IMN) PROGRAMS FOR MALARIA CONTROL IN RURAL AFRICA:

Lessons Learned from the Bagamoyo Bednet Project, Tanzania

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Introduction

The Bagamoyo Bednet Project (BBNP), a five-year (1991-1994) project funded by the U.S. Agency for International Development (USAID), implemented an insecticide-treated mosquito net (IMN) program in the Bagamoyo district of Tanzania. The project's aim was to measure IMN's impact on malaria transmission and determine how best to encourage community participation in implementing and sustaining such a disease control program. This paper discusses lessons learned from the BBNP and other studies about a number of factors or constraints that may undermine the sustainability of large scale IMN programs in Africa.

Background

Malaria continues to be one of the foremost public health problems facing sub-Saharan Africa, whether one considers malaria-associated mortality and morbidity, or social and economic impact. The spread of chloroquine-resistant *Plasmodium falciparum* throughout the continent has given further impetus to the search for alternative technologies that might play a role in an integrated malaria control strategy. One line of investigation has focused on measures that provide protection from adult mosquitoes. These include mosquito nets, eaves curtains, window curtains, window screening and protective clothing (e.g., Rozendaal 1989; Curtis et al. 1990; Bermejo and Veeken 1992; and Choi et al. 1994). A general finding of this research has been that treatment of netting material or fabric with a pyrethroid insecticide greatly increases the protective effect. The insecticide is essential for protection from malaria. People sleeping under nets not treated with insecticide do not receive significantly fewer infective bites than those without nets (Lindsay et al., 1989). Recent studies in Ghana (Binka et al., 1996) and Kenya (Nevill et al., 1996) have confirmed earlier findings in The Gambia (Alonso et al., 1991) that insecticide-treated mosquito nets (IMN) can significantly reduce childhood mortality. In light of these and other studies, the World Health Organization (WHO/TDR) and the International Development Research Centre (IDRC) have issued a call for operational research into how best to promote the use of insecticide-treated nets on a large scale (Lengeler et al., 1996).

The overriding question this operational research must address is: how can programs that promote the use of insecticide-treated nets be made sustainable, given economic constraints and competing priorities at both the government and at the household level? Recent papers by Carnevale (1996), Fielden (1996), Zimicki (1996), and Lines (1996) set out in considerable detail a wide range of research questions that need to be investigated. However, one reason that there has been little commitment to large scale implementation of mosquito net interventions by either government or donor organizations, is a concern for how such interventions will be implemented and sustained.

In many ways, operational research on the implementation of IMN interventions is at the same stage as was research on oral rehydration therapy (ORT) after clinical trials had proven that its efficacy was comparable to that of intravenous administration of fluids for the treatment of children with dehydration secondary to diarrhea. Although it was known that ORT worked, it was not known how best to put this technology into the hands of parents of young children and health workers. A seemingly insurmountable series of obstacles to the implementation of national ORT programs was present, including lack of commitment to the promotion of ORT by Ministries of Health, opposition to its use by medical practitioners, differences between parents and health workers with respect to how diarrhea is defined, and the existence of alternative treatments such as antibiotics that both parents and health workers often considered to be more effective than ORT. The course ultimately taken by operational research on the promotion of ORT is summarized by Northrup (1993).

Factors affecting the sustainability of IMN programs

A number of factors favor the sustainability of IMN programs. First, both the netting and the insecticide have enjoyed high levels of acceptance in the various IMN efficacy trials that have been conducted, even in areas where few people had slept under nets prior to the trial. Second, in countries such as The Gambia and Guinea-Bissau, rates of net usage as high as 86 percent have been reported among ethnic groups that ascribe high social value to having a net (Aikins et al., 1994). These high levels of usage can occur even in the absence of a program to promote their use. Third, many households, particularly in urban areas, are already spending significant proportions of their household income on mosquito coils, aerosol sprays, and treatment of cases of malaria, a finding that is thoroughly reviewed by Carnevale (1996). Rather than asking people to allocate more household resources to malaria, we are asking them to reallocate some of what they are already spending to the purchase of mosquito nets and insecticide with which to treat them. According to calculations by Brinkmann and Brinkmann (1995) for Cameroon, this reallocation might result in an overall reduction in the amount of money spent by households on vector control and treatment of malaria, even though they assumed the cost of a net to be $23.20.

Nevertheless, many factors stand in the way of sustainability, five of which will be the main focus of lessons learned from the Bagamoyo Bednet Project. The one that has received the most attention in the literature has been the cost of the nets. Brinkmann and Brinkmann (1995) calculate that it would cost $21.8 million to provide 80 percent of the population of Malawi with nets, a figure that represents 49.4 percent of Malawi's 1990 budget for government health services of $44 million. Therefore, most of the funds for the purchase of nets will therefore have to come from households. Those authors thought that although villagers may save money over a period of three or more years through a decline in the incidence of disease, they often do not have cash for the initial investment of nets, and so "... the population has to be fully convinced that treated mosquito nets are effective and necessary, and should give them a higher priority above most other goods" (Brinkmann and Brinkmann, 1995).

A second barrier is that most people appear to see nets as a mosquito control measure, rather than as a malaria control measure (Aikins et al., 1994; Stephens et al., 1995). In an urban area with inadequate treatment of wastewater and extremely high year-round populations of culicine mosquitoes, this is an advantage. In such a situation, social marketing of IMNs that emphasizes protection from mosquitoes and makes little or no mention of malaria would be expected to be successful. In a rural area where overall mosquito densities are far lower, but densities of the more secretive and nocturnal *Anopheles* malaria vector mosquitoes are higher, promotion of nets becomes more difficult. If the focus of the promotion is exclusively on mosquitoes, we would expect people who live near rice fields, ponds, and rivers to purchase nets, while people at some distance from such sources of mosquitoes would see nets as less of a priority. During the dry season, it may be difficult to maintain any net usage, even though malaria transmission is continuing.

A third barrier is lack of a structure at the village level to assume responsibility for ensuring high rates of regular re-treatment of the nets with insecticide. Once the insecticide wears off, the effectiveness of the nets as a malaria control measure is also lost. Many projects pay little attention to this barrier. Nets are given away or sold on a one-time basis, with no provision made for regular re-treatment. If the private sector assumes responsibility for re-treatment, it typically responds to demand rather than creating it, and typically does not reach remote villages. This will likely result in regular re-treatment rates that are insufficient to have an impact on malaria. A structure is needed at the village level that can not only arrange for regular re-treatment of the nets, but also create and sustain community-wide demand for it.

A fourth barrier is a lack of willingness to pay for the insecticide. This is driven by a lack of appreciation of the role of the insecticide in health protection, and by the cost and personal inconvenience that arise from having to re-treat the net periodically. In fact, there are two basic ways in which nets may be treated with insecticide. Wash-resistant insecticide may be incorporated directly into the fibers, in which case re-treatment may not be necessary for two years or more (Miller et al., 1996). Alternatively (and more usual), if the insecticide is not incorporated into the fibers, nets need to be re-treated with insecticide every six to twelve months. Netting with insecticide incorporated directly into the fibers will cost significantly more than ordinary netting (Miller et al., 1996). Unless people have an appreciation for the benefits of the insecticide it is unlikely they will invest in this more costly netting. For netting requiring re-treatment, people must not only be willing to pay for the insecticide, but also to invest time and effort in bringing their nets to a central location for re-treatment or to purchase the insecticide and re-treat the netting on their own.

In efficacy trials, the cost of the insecticide is usually absorbed by the project. When external funding ends and people are asked to pay for the insecticide, rates of re-treatment may drop considerably, especially if there has been no publicity and awareness creation among the people. This occurred, for example, in The Gambia when villagers were asked to pay $0.50 for re-treatment of nets in 1993. There was a sharp drop in coverage and an increase in child mortality rates. In villages where mortality surveillance had been conducted as part of an earlier study, child mortality rates returned to pre-intervention values (D'Alessandro et al., 1995), in spite of the fact that careful research had been conducted on locally acceptable

ways of paying for insecticide re-treatment (Mills et al., 1994).

A fifth and final barrier is lack of national and district commitment to mosquito net interventions. Both Ministries of Health and non-governmental organizations are facing two types of pressure: increasing demand for services as a result of continuing population growth and emergence of new health problems such as HIV/AIDS, and decreasing resources for health from both governments and donor organizations. Although governments generally list malaria as one of their health priorities, inadequate funding and a lack of trained personnel including entomologists, epidemiologists and applied social scientists (e.g., health education/communication, economics, anthropology) make it difficult to commit to any new public health initiative. Unfortunately, without supervision, coordination, and technical input, it is unlikely that either the private sector, non-governmental organizations, or individual communities can implement an effective malaria prevention program based on IMNs.

Bagamoyo Bednet Project Design and Implementation

Over a period of five years, the authors of this report were involved in the design, implementation and assessment of a bednet project, funded by the U.S. Agency for International Development (USAID), in the Bagamoyo District of Tanzania. The Bagamoyo Bednet Project (BBNP) was designed to set up an IMN program with strong community participation, to measure its impact on malaria transmission and to determine how communities can be involved in the implementation and sustainability of such a disease control program.

The BBNP project addressed several key objectives related both to malaria control and local sustainability. In the 13 villages that constituted the project area, malaria transmission was reduced and the health of children improved considerably. People felt that overall health had improved and perceived some benefit from their participation. By developing an understanding of the local perceptions of malaria, the project staff were able to develop effective messages that were communicated to the people by posters, play acting, talks, and through local leaders and elected villagers resulting in a high level of community participation. People were prepared to purchase nets and insecticide and a system for accumulation of capital was set up within each village. A management structure evolved and was defined in a locally developed constitution.

Lessons learned:

During the course of the project implementation, lessons were learned about the five major barriers to sustainability. These are the actual cost of purchasing a net, limited awareness of the health impact of endemic malaria, absence of a local implementing infrastructure, misunderstandings about the role and cost of the insecticide and, finally, absence of a national and district commitment to malaria control.

For malaria control to be successful, the local community must face and overcome each of the perceived barriers. The following objectives must be clearly addressed in the design and implementation of a program to ensure its sustainability:

- The community should understand the nature of the problem, the impact of malaria on health and the wide range of consequences of malaria infection. This will make people aware that they will benefit personally from protection.
- People should feel that they can afford the initial costs of purchasing treated nets.
- There must be the political will to support a malaria control intervention using IMNs.
- A village infrastructure should be developed to deliver messages to the people about the importance of treating the nets, and to arrange for regular net re-treatment.
- People must appreciate the critical role of insecticide in the program and the need for regular re-treatment of nets.

The key to sustaining a community-based implementation plan is to build up a partnership among the village, district authorities, and central government. It is important for the community to acquire capital reserves to pay for services and future costs of procurement of IMN supplies. This could be done by investing all proceeds of sales in village-operated revolving fund. With such assets, village communities can become self sufficient and can take on program management, promotion, and implementation.

Despite local management, promotion, and sale of commodities, there still may be a substantial need for external monitoring and a high level centralized authority with expertise and the ability to coordinate activities. Revenues from local bednet sales would not pay for this. Therefore, such personnel and their functions would have to be provided from regular district and national funds allocated to health services. Such services could be contracted from local universities or research institutes.

The main role for the private sector in these programs would be to ensure that supplies and services needed are available at competitive prices in village communities at the appropriate times.

Conclusion

The Bagamoyo Bednet Project built upon results from numerous studies carried out in the Gambia, Tanzania, and other parts of Africa, and benefited from those experiences. However, it was in the area of sustainability that the project has expanded knowledge. Piece by piece, the five constraints to IMN program sustainability were addressed and solutions were found. These solutions were reasonable and effective in the Tanzanian situation but they offer only one approach to develop a sustainable intervention, which may not apply everywhere. However, the procedures adopted were effective in controlling malaria (Premji et al., 1995a) and have the basis for sustainability. They could be used elsewhere as guidelines by health officials trying to develop a sustainable malaria control intervention involving the community at large.

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